



## **Investigating Disruptions to Channel Missions - What's the Breaking Point?**

GRADUATE RESEARCH PROJECT

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**INVESTIGATING DISRUPTIONS TO CHANNEL MISSIONS - WHAT'S THE  
BREAKING POINT?**

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## **Abstract**

The Department of Defense will continue to operate in a challenging fiscal environment for the foreseeable future and Air Mobility Command (AMC) will not be immune to the requirement to cut costs while maintaining the ability to accomplish its mission. Understanding the capability of the organic strategic airlift fleet to accomplish channel missions is one way to determine methods to efficiently use critical resources.

This research paper analyzes and discusses the capacity of the organic strategic airlift fleet in the United States Air Force (USAF) to fly all scheduled channel sorties and determine the aircraft that would be available to absorb airlift requirements as a result of contingency operations. This research will analyze the historical demand for channel missions and historical aircraft availability to determine the average number of strategic aircraft available per day. A two year average is developed for channel demand using organic aircraft and organic aircraft availability and then compared with total channel demand. Additionally, a review of contingency and Special Assignment Airlift Missions from 2010 and 2011 is accomplished to determine expected demand on the fleet. Finally, the aircraft availability is compared to channel and contingency sortie demand to determine the breaking point for strategic airlift.

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Royce M. Lippert

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## **I. Introduction**

### **General Issue**

As the war in Afghanistan comes to an end and the airlift demand in the United States Central Command Theater is reduced, the United States Transportation Command (USTRANSCOM) will have to reevaluate its use of the Civil Reserve Air Fleet (CRAF) partners as well as organic airlift to meet the requirements of the other geographic combatant commanders. According to a Government Accountability Office report, “DOD projects that by 2015, its peacetime business will decline by an estimated 66 percent as it returns to pre-September 11, 2001 levels, raising concerns within DOD and among CRAF participants about the effect this loss of business will have on the carriers and their ability to continue participating in the program” (Merritt, 2013). The reduction in peacetime business will require the DOD to reconsider the mix of organic airlift and commercial airlift.

Additionally, the Department of Defense faces a challenging fiscal environment. “The Air Force alone accounts for 48 percent of the total Department of Defense energy consumption and slightly more than 50 percent of the DODs total energy costs, with the vast majority of this for aviation fuel. This startling statistic also means a hefty energy bill” (Bates, 2013). While this paper will not address the differences in cost between contracts with CRAF carriers and using organic airlift, it will need to be researched prior to making any changes to the mix between civilian and military airlift.

An analysis of the strategic organic airlift capability based on tail availability will help determine the organic fleet’s ability to increase its channel support and determine

what the breaking point would be if a contingency operation were to begin depending on the size of the operation. Historically, cargo requirements have been determined based on million-ton miles per day (MTM/D). This analysis will be based on aircraft flown regardless of cargo demand. This research is also based on aircraft availability versus capacity in terms of MTM/D.

## **Background**

The DOD defines channel airlift in Joint Publication (JP) 4-09 as “Channel airlift missions support global distribution operations over established worldwide routes (combatant command or Service-validated) that are served by scheduled DOD aircraft under AMC control or commercial aircraft contracted and scheduled by AMC” (Joint Chiefs of Staff, 2010). As of 4 December 2013, there are 112 validated channel airlift missions that service locations around the world (Tanker Airlift Control Center, 618th Air and Space Operations Center, 2013). Approximately 44 of the channels listed in the AMC sequence listing are considered contingency channels. Those contingency channels that are supporting Operation Enduring Freedom will be excluded from the data analysis since the assumption is those missions will be cancelled post-2015. The execution interval for each individual channel varies based on demand at the location being supported. A validated channel does not necessarily mean that a mission is being flown to that location on a set schedule. This inconsistent schedule creates unique challenges when forecasting airlift requirements. This inconsistent demand combined with unscheduled demand as a result of contingency operations results in a dynamic environment that can wreak havoc on the channel airlift system. In addition, requests to cancel or suspend

AMC channels is not nearly as extensive as establishing a channel. At a minimum, a request must originate from the Overseas Combatant Commander (United States Transportation Command, 2011).

It is also important to discuss contingency missions and to be careful when attempting to use the concept when discussing contingency operations. JP 4-09 states “during a contingency, the vast majority of airlift sustainment will move on channel missions” (Joint Chiefs of Staff, 2010). In that statement, the joint publication is referring to a contingency operation. For strategic airlift, if the mission being flown does not fall into the channel category, it will normally fall in the Special Assignment Airlift Mission (SAAM) category. SAAMs are generated when special consideration is required ranging from type of cargo to number of passengers being moved. Not all SAAMs will have the same impact on channel missions. In many cases, the impact is related to the amount of time that the Tanker Airlift Control Center has to plan for the operation. For example, when President Obama traveled to Africa from June 27<sup>th</sup> to July 2<sup>nd</sup>, 2013, the Tanker Airlift Control Center had months to plan and could therefore adjust the channel schedule, request for additional volunteers from the Air Reserve Component and “surge” active duty squadrons to meet all the requirements associated with the Presidents movement as well as the channel activities. However, SAAMs that support humanitarian operations following major natural disasters do create problems with the channel system. The disruptions come about due to in-system selects and as a result of the spin up time required to get additional resources at home station marshalled and ready to respond.

## **Research Objectives/Questions/Hypotheses**

The intent of this research is to determine the potential disruption to channel missions based on the demand from the contingency operation. It will also attempt to determine how big the contingency requirements can get before the channel system is “broken”. It will then explore potential mitigation efforts to continue channel cargo movement including the shifting of CONUS cargo missions to the C-130, using KC-10s and potential commercial augmentation. The research answers the following questions:

1. How many C-17A Globemaster III and C-5A/B/C/M Galaxy aircraft are available on a daily basis?
2. How many channel missions are flown on a daily basis?
3. How many channel missions does the organic strategic airlift fleet support and how much additional demand could they absorb?

The hypothesis is that the daily demand for organic strategic airlift is lower than the aircraft available but when a contingency operation begins, the demand is greater than supply which therefore creates a disruption in the channel airlift system.

## **Research Focus**

This research paper will focus on scheduled channel cargo missions using an organic system of primarily C-17 and C-5 aircraft, post-2015. Aircraft availability numbers as reported by the Air Force Logistics, Installations, and Mission Support – Enterprise View (LIMS-EV) system will be used to determine a projected number of organic strategic airlift available based on historical availability. Then, adjusting the percentage of airlift flown by commercial carriers, a determination on the potential for

disruption as a result of a contingency operation is provided. The focus will be on specific days versus analyzing the entire event with the understanding that AMC does have the ability to surge when required to meet the mission.

## **Methodology**

The case study qualitative research design is used to accomplish this research in an attempt to identify patterns within the data. “A case study may be especially suitable for learning more about a little known or poorly understood situation” (Leedy, 2010). As was discussed in the introduction, the USAF faces budget constraints that must be addressed.

Using LIMS-EV to determine C-17 and C-5 aircraft available on a daily basis dating from January 1, 2011 to December 31, 2012, an average number of aircraft available is determined. Additionally, an average number of channel missions flown regardless of supporting aircraft, excluding channels for Afghanistan is determined. The daily channel demand signal is examined to check for any seasonal spikes or declines and is checked against contingency operations that occurred during the time frame examined.

## **Assumptions/Limitations**

The following assumptions apply to this research in order to set a baseline for calculations regarding aircraft availability and data analysis for historical channel operations.

Assumption 1: Operations in Afghanistan will continue to decrease and the requirement for sustainment operations will be supported via channel operations.

Assumption 2: No new significant world events or contingency operation will begin requiring substantial airlift support for a prolonged period of time.

Assumption 3: Contracts for CRAF participants are not required to ensure their survival and any failures as a result of a shift in airlift assignments is not the primary cause for a company to fail.

Assumption 4: The channel airlift data provided and used is accurate. If missions are missing from the data set, the number is insignificant and does not impact the calculations in their totality.

Assumption 5: There will be no major change to the organic strategic airlift fleet with regards to number of aircraft in the fleet and no major shift to the force mix between the Active Duty and Air Reserve Component (Air National Guard and Air Force Reserve).

Assumption 6: The organic strategic airlift fleet consisting of C-17s and C-5s can support all channel missions managed and tasked by the Tanker Airlift Control Center. The assumption is that there are no channels being scheduled that require a special type of handling beyond what the organic fleet can provide.

Assumption 7: All C-17s and C-5s listed as available in LIMS-EV are actually available and able to be tasked by the Tanker Airlift Control Center or the appropriate command and control organization.

Assumption 8: Aircrew availability is not a limiting factor. If a mission is tasked, the unit has a crew that is trained and qualified.

Assumption 9: After an aircraft departed on a mission, it flew every day while supporting that mission (less than 24 hours between launches).



Due to the complexities of managing strategic airlift, it is necessary to place a few boundaries on the scope of this research. This research is not intended to determine the appropriate size of the strategic airlift fleet or the optimization and utilization of that airlift. In addition, the purpose of this research is not to recommend limitations to the support that should be provided to a geographic combatant command during a contingency operation. It will however, focus on the post-wartime airlift requirements for the DOD and impacts that contingencies will have in that post-wartime environment. An additional assumption is that squadrons are not operating in a surge capacity. During a build-up to major operations, prior to a contingency operation and several days after a major natural disaster occurs, airlift squadrons are often tasked to surge levels. This paper is not meant to determine or examine the ability of the channel system to operate during the surge. It is meant to identify and discuss the initial disruption that occurs as a result of additional airlift missions being required at a specific point in time.

## **Implications**

The results of this study are not projected to cause a major change in organic strategic airlift usage or a change in contracting to commercial carriers for airlift. Instead, it should be used as a planning tool to determine the potential disruption to the channel airlift system and the ramifications that disruption has to USTRANSCOM customers. In the challenging fiscal environment that the United States military faces over the next 8 to 10 years, strong consideration needs to be given to utilizing its resources in an efficient manner while also maintaining the appropriate level of capability to meet the Combatant Commanders objectives. The Mobility Capabilities Requirements Study (2016), which

will be discussed later, provides an analysis on three distinct scenarios to determine the appropriate organic airlift fleet and CRAF utilization. Unfortunately, the MCRS-16 does not address peacetime operations and small contingency operations and how those operations impact the channel airlift system. This research attempts to fill that gap.

## **II. Literature Review**

### **Chapter Overview**

There are a number of issues that directly impact channel airlift requirements including competing requirements within the DOD, political ramifications associated with the basing of military assets and as well as cost concerns for commercial carriers. “The National Airlift Policy states that military and commercial resources are equally important –and interdependent-in fulfilling the national defense airlift objective” (Merritt, 2013). In a utopian system, national carriers would want to participate in CRAF out of national pride. However, national pride does not pay the bills, does not improve the bottom line of the financial statement, and it does not always satisfy the stakeholders in the company. Additionally, the demand for strategic airlift is sometimes so high around the globe that lower priority cargo must be delayed so that the aircraft can be used for a higher priority mission. A relatively low demand in one month is not always an accurate predictor for the next. By the end of the literature review, the reader should have an understanding of CRAF and a cursory understanding of the disruptions that can occur in the channel airlift system.

## **Process Owner**

In September, 2003, Secretary of Defense appointed USTRANSCOM as the distribution process owner (DPO) (Ross, 2003). “As the DPO, USTRANSCOM is tasked with directing, supervising, coordinating, synchronizing and developing processes, doctrine, business rules, information technology tools, systems, and procedures for all of the players in the equation to be more efficient and effective” (Ross, 2003).

USTRANSCOM faced several challenges as they took on the process owner role.

“Shippers have grown accustomed to the reliability and time-definite delivery (TDD) standards provided by express carriers such as Federal Express (FedEx) and United Parcel Service (UPS)” (Condon & Patterson, 2004). The DOD as a whole has struggled to keep up with technology and with updating its system. As a result of the priority system used to determine the use of Air Force cargo aircraft, shippers have learned methods to change the priority of their cargo thus causing ripple effects in the system.

“Unforeseen requirements with higher priorities, which may result in airlift being pulled from channel missions to support other, more important missions” creates uncertainty (Condon & Patterson, 2004). To shippers, this lack of visibility and uncertainty creates a dis-incentive to use the Defense Travel System (DTS) and a lack of confidence in the system. The DPO will have to address these challenges as the mix between organic and commercial airlift is reviewed.

## **Airlift Capacity**

Determining the capacity for civilian and military aircraft can be accomplished in a similar manner. Ultimately, it is dependent on capacity of the aircraft and aircraft

availability. Air Force Pamphlet (AFPAM) 10-1403 provides planning factors for a cross section of operations. When deciding on out-year purchases, civilian and military leaders often use MTM/D. However, “fleet capacity is generally more optimistic than actual Fleet Capability for a particular contingency” (Department of the Air Force, Air Force Pamphlet 10-1043, 2011). MTM/D does not directly address aircraft availability. The calculations for MTM/D will often drive larger fleet sizes due to planning factors associated with being mission capable. In an environment where supply (capacity) exceeds demand (requirements), MTM/D is not as critical as available resources. The question is not whether or not the cargo can be moved. The question is who is going to move the cargo? Airlift capacity for this research is based purely on the availability of mission capable aircraft as reported in LIMS-EV.

### **Mobility Capabilities & Requirements Study 2016 (MCRS-16)**

The Mobility Capabilities & Requirements Study (2016) is a key document used to determine force structure requirements needed to support the national command authority and joint forces. The MCRS developed three cases that could be used by decision makers for future mobility force structure. All three cases examined force requirements during large scale land campaigns combined with other operations. For all three cases, “DOD relies on the Civil Air Fleet (CRAF) as the primary means of delivering passengers and bulk air cargo” (Office of the Secretary of Defense, 2010). None of the cases discussed the impact to channel airlift operations because the priority for channel airlift is lower than contingency operation missions when combatant commanders and their warfighters need support.

Though the MCRS-16 review is only three years old, plans are already under way to begin work on a new study to examine how the future force structure may look. The new study is being dubbed MCRS 2018 and is being proposed in the Fiscal 2015 budget (Tirpak, 2014). The strategic airlift fleet will continue to be a critical component and has found supporters across the DOD including the Army. “Fanning said Army Chief of Staff Gen Raymond T. Odierno insisted a smaller Army would require greater mobility, not less, to be flexible enough to get where it’s needed quickly” (Tirpak, 2014).

### **Common Disruptions**

Disruptions to the channel airlift system can occur for any number of reasons. Some are the result of natural disasters such as the 2010 Eyjafjallajökull volcano eruption. The initial eruption occurred on March 20<sup>th</sup>, 2010. The ash cloud that resulted from the eruption eventually resulted in a massive disruption to air travel causing the cancellation of about 4,000 of the 20,000 daily flights across Europe on April 14 and April 15 (CBS News, 2010). Most of the airspace across Europe would eventually be closed from April 15 until April 20, 2010 (Volcano Facts, 2010). The disruption that impacted Air Mobility Command as a result of this event occurred in the first couple of days. Eventually, alternative flight plans were used such as traveling westbound when departing the continental United States or shifting to a different mode of transportation such as truck or rail.

Natural disasters also lead to a disruption in the airlift system as a result of the humanitarian response required to assist those in need. The USAF response to Hurricane Katrina in August 2005 was immense with “Air Force fixed-wing aircraft flying 4,095

sorties, 3,398 of these on air mobility missions” and included 15 C-17s and 16 C-5s (Haulman, 2007). The USAF response to subsequent disaster relief operations around the globe has been just as impressive. Varying levels of airlift was provided in support of Operation TOMODACHI in March 2011, following a 9.0 magnitude earthquake off the coast of Japan resulting in a large Tsunami. Mackenzie Eaglen dubbed March 2011 as The Air Force’s ‘March Madness’ as a result of the demand placed on the USAF in that month. The Pentagon’s Transportation Command Chief reported that for the first time ever, “every combatant commander had a Priority One mission requiring the help of the Air Force” (Eaglen, 2012). Prior to Operation TOMODACHI, the USAF provided a significant amount of support to Haiti in support of Operation United Response following a 7.0 earthquake in January 2010 that decimated the country’s infrastructure.

Unpredictable natural disasters such as earthquakes and tsunamis place a unique strain on the airlift community because those events cannot be planned for in the same manner that Presidential travel or other type of SAAMs can be scheduled.

Another common type of disruption includes supporting the United Nations and allied countries around the world. On December 9<sup>th</sup>, 2013 it was announced that along with British partners, U.S. C-17s would begin transporting peacekeepers in support of the Central African Republic within 24 hours (Jordan & Sisk, 2013). A change in airlift schedule inside of 24 hours often results in crews either being in-system selected to support the operation or a crew that was already scheduled to depart home station being shifted from a different mission. Unscheduled operations such as this result in disruptions to other missions. The magnitude of the disruption will depend on the number of aircraft involved and then length of time that the support is needed. The further planners get from

the initial reaction to the mission, the smaller the disruption will be because the planners can adjust schedules, reduce training fences, and request volunteers from the ARC. The disruption can be thought of as a pebble being dropped in a pond. The initial wave is bigger than subsequent waves and eventually the surface of the water returns to its original state.

### **Civil Reserve Air Fleet (CRAF)**

“The primary incentive for commercial carriers to participate in the CRAF program is the opportunity to obtain DOD peacetime business” (Merritt, 2013). CRAF carriers must be U.S. flagged carriers and operate under FAA Part 121 or 135 rules. The CRAF consists of three major segments that the supporting carriers are contracted to support: international, national and aeromedical evacuation. In addition, the international segment is sub-divided into long-range and short-range sections (Air Mobility Command, 2011). Some carriers support all three while others only support one of the segments. The number of carriers and aircraft supporting and available for CRAF activation has fluctuated over the years based on current market conditions in the airline industry as well as the incentives being provided for carriers to participate. Currently, participation is at an all-time high with annual DOD payments to CRAF carriers of \$3.4 billion (Grismer, 2011). There are three primary stages associated with the activation of CRAF described in a Government Accountability Office (GAO) report (Merritt, 2013):

Stage I – minor regional contingency or other situations where AMC cannot simultaneously meet both deployment and other airlift requirements.

Stage II – major theater war or defense airlift emergency short of a full national emergency.

Stage III – more than one major theater war at the same time or operate in a larger crisis, including a national emergency declared by the President or Congress.

CRAF stage I has been activated on two occasions over the life of the program. The first activation was from August 18, 1990 through May 24, 1990 in support of Operations Desert Shield and Desert Storm and included parts of stage II. The second activation of stage I was from February 8, 2003 through June 18, 2003 in support of Operation Iraqi Freedom and Enduring Freedom and was only for the passenger segment (Merritt, 2013). Stage III has never been activated.

As of October 24<sup>th</sup> 2013, there were 92 Department of Defense approved Air Carriers and 27 that were eligible for participation in CRAF and are listed in Table 1 (Whitlow, 2013) and the total number of aircraft available is listed in Table 2 (Caslen, 2013). CRAF partners are divided into three teams; Alliance Team, Federal Express Team, and Patriot Team (Caslen, 2013). The lead company for each team coordinates with USTRANSCOM for contracts as part of the fixed buy and expansion buy for airlift. Each team is then responsible for distributing the assigned lift as they deem acceptable.

As the number of troops in Afghanistan significantly drops over the next 12 months, the demand for airlift support will also decrease. A reduction in contingency operations will result in a shift of available assets and there will be a greater supply of organic and commercial airlift to fly channel missions.



Table 1: CRAF Eligible Carriers (Caslen, 2013)

ABX Air Inc	Air Transport International Inc	Alaska Airlines Inc	Allegiant Air LLC
American Airlines Inc	Atlas Air Inc	Delta Airlines Inc	Evergreen International Airlines Inc
Federal Express Corp	Hawaiian Airlines Inc	Jetblue Airways Corp	Kalitta Air LLC
Lynden Air Cargo LLC	Miami Air International Inc	MN Airlines LLC	National Air Cargo Group Inc
North American Airlines	Northern Air Cargo Inc	Omni Air International Inc	Polar Cargo Worldwide Inc
Sky Lease I Inc	Southern Air Inc	Southwest Airlines Co	United Airlines, Inc
United Parcel Service Co	US Airways Inc	World Airways Inc	

Table 2: CRAF Fleet Composition (Caslen, 2013)

SEGMENT	SECTION	# AIRCRAFT
INTERNATIONAL LONG-RANGE	PASSENGER	235
	CARGO	153
INTERNATIONAL SHORT-RANGE	PASSENGER	122
	CARGO	4
AEROMEDICAL		0
ALASKA (Cargo only)		0
DOMESTIC		36
Total Aircraft		550

USTRANSCOM and AMC will need to strike a balance between utilizing organic airlift and the cheaper commercial airlift. Because CRAF is a voluntary program, removing the incentives for carriers to participate by reducing their peacetime contract business could result in a reduction of participating carriers participating in the program.

“USTRANSCOM’s goal is to keep the CRAF a viable strategic and operational asset,

able to rapidly respond to changing wartime requirements” (Grismer, 2011). However, a GAO report found that the “DOD has not developed policies regarding the enforcement of its business rules, such as the 60/40 rule that states that participants should fly only 40 percent of their total business for DOD” and the “DOD has not developed policies or economic incentives that promote CRAF modernization and this may hinder CRAF carriers from modernizing their aircraft” (Solis, 2009). Addressing these issues will be key as a mix between commercial and organic airlift is adjusted. Additionally, the interoperability between CRAF partners and the Tanker Airlift Control Center has been critical to the success of operations around the world. Rapidly reducing the contracts provided to CRAF partners may result in a loss in synergy between the DOD and its civilian partners.

The initial desire to eliminate contractual airlift or reduce it to the minimum required to entice civilian partners to participate in CRAF may be not be possible due to the logistics involved with some United States military operations. One example that demonstrated the potential necessity for contract airlift was during the Natural Fire 2010 exercise held in Africa. As detailed in *Rethinking the Last Tactical Mile: Adaptive Air Logistics in Africa*, U.S. Army Africa (USARAF) had to deal with multiple challenges while trying to utilize organic airlift (Gaddis, 2012). While the airlift was available, the C-130s were unable to use the airfields identified as suitable. At the end of the exercise, the C-17s that had originally been assigned were re-tasked to higher priority missions. This resulted in a significant delay for the re-deployment of the forces that participated in the exercise. The following year, USARAF chose to use a different strategy during exercise Atlas Drop. In the coming years, as the budget constraints continue to reduce

capabilities, decision makers will have to look at the trade-off between utilizing organic airlift and accepting the potential disruptions in the lift or use contracts with CRAF carriers. Decision makers will also have to weigh the importance of incentives for carriers to participate in CRAF.

## **Summary**

This literature review provides a background on the factors influencing organic strategic aircraft utilization, airlift capacity, and the unique relationship that CRAF partners have with channel missions. This research also highlights the dynamic nature of strategic airlift based on geo-political events as well as natural disasters. The methodology section discusses historical aircraft availability, channel mission utilization and the qualitative research design used for this research.

## **III. Methodology**

### **Chapter Overview**

This chapter discusses the methodology used to measure the disruption that occurs to the channel airlift system when unscheduled contingency operations occur. It is necessary to calculate the number of organic aircraft available and then to examine the forecasted channel missions based on the validated AMC channel missions. Historical channel missions flown are reviewed and analyzed but decision makers should be cautious drawing conclusions from that data due to the channel demand that existed as a result of Operation Enduring Freedom and Operation Iraqi Freedom.

## **Organic Strategic Airlift Availability**

In order to determine the historic total number of organic strategic airlift aircraft available, actual aircraft available by day will be obtained via the Weapons System View of LIMS-EV for calendar years 2011 through 2012. The average number of aircraft available will then be then calculated for the C-17 and the C-5 individually by year. Several filters can be applied in the Weapons System View when identifying aircraft available. For the purpose of this research aircraft with purpose codes of: test (EI), training (TF), combat tactics OT&E (CB), and test support (EH) are excluded. Those categories will be excluded to provide a better snap shot of aircraft that are actually available on given day with the assumption that testing and training must occur regardless of operations tempo. Aircraft with purpose codes of combat support (CA), combat (CC), combat auxiliary support (CF), industrial fund (IF), special activity (ZA), and operational support (ZB) will be included. Explanations for the purpose codes can be found in Table 9 located in Appendix A. After excluding the mentioned categories, the search results will extracted to an excel spreadsheet so that the data can be analyzed. A pivot table is used to determine the number of aircraft available by type on each day of the year.

## **Channel and Contingency Mission Activity**

All channel and contingency mission activity that is analyzed for this research was received from AMC A/9 in an excel spreadsheet broken down by day. A pivot table is used to identify the number of aircraft flown by type on a given day. Data sets for calendar year 2011 and 2012 are investigated separately and then averaged by year. All

channel missions supported by the Tanker Airlift Control Center are included in the analysis and encompassed 48,331 aircraft uses. This was accomplished to ensure that the maximum number of channels that would need to be supported were included in the review. As a result of including all channel missions supported, a wide range of aircraft was included (see Table 3). A quick review of the table indicates that some of the channels were supported by aircraft with capabilities that the C-17 and C-5 cannot support such as such short field landings of less than 3,500 feet. Keeping those missions in the data set allows for a conservative assumption that the channel demand is not higher than indicated.

Table 3: Aircraft Supporting Channel Missions

A31020	A32020	A33030	AC130U	B73740
B73780	B74710	B74720	B74730	B74740
B75720	B767	B76720	B76730	B77720
C005A	C005B	C005C	C005M	C012R
C012U	C017A	C020B	C020E	C020F
C020G	C020H	C021A	C027J	C130E
C130H	C130J	C21220	CS441	DC006
DC008	DC0103	DC873	DHC8	DHC81
F016I	G1159	HS1258	KC010A	KC135R
KC135T	L10030	LR035A	LR036	MC130H
MD011	MD011F	MD082	MD083	U028A
WC130H	WC130J			

For the analysis of supported contingency missions in 2011 and 2012, utilization codes supporting Operation Enduring Freedom were excluded. These missions are not regularly scheduled and will not be required in the post-2015 timeframe. Excluding utilization codes P7BE and P7BF (SAAM: Enduring Freedom) from the data set eliminated 21,773 records and 16,385 remained. This indicates that over 57% of the missions in 2011 and

2012 for contingency and SAAM missions were flown supporting Operation Enduring Freedom. It is important to note that this review was based on tail utilization on a given day, not based on number of missions that specific aircraft flew on a given day.

## **Summary**

This chapter discussed the design used to determine the organic strategic aircraft availability and the channel and contingency mission activity. The average aircraft available for 2011 and 2012 provides decision makers with the ability to determine anticipated capacity based on historical data. Additionally, determining average channel demand beyond Operation Enduring Freedom paints a picture for decision makers on what the future demand for airlift may encompass. The next chapter will discuss the results and provide an analysis of aircraft availability and channel demand.

## **IV. Analysis and Results**

### **Chapter Overview**

This chapter details the analysis conducted on the LIMS-EV aircraft available numbers, the channel aircraft mix between commercial and organic airlift, and review channel mission demand (excluding Operation Enduring Freedom) and draw conclusions from the results. The investigative questions will be reviewed and answered using the results from the analysis.

## Results

### *Organic Strategic Aircraft Availability*

The average number of aircraft available for calendar years 2011 and 2012 was 142.4 C-17s and 44.9 C-5s with a standard deviation of 4.9 and 4.2 aircraft respectively. Figure 1 depicts the relationship between those aircraft available and the type of missions flown. The channel demand average includes all aircraft types as displayed in Figure 1.

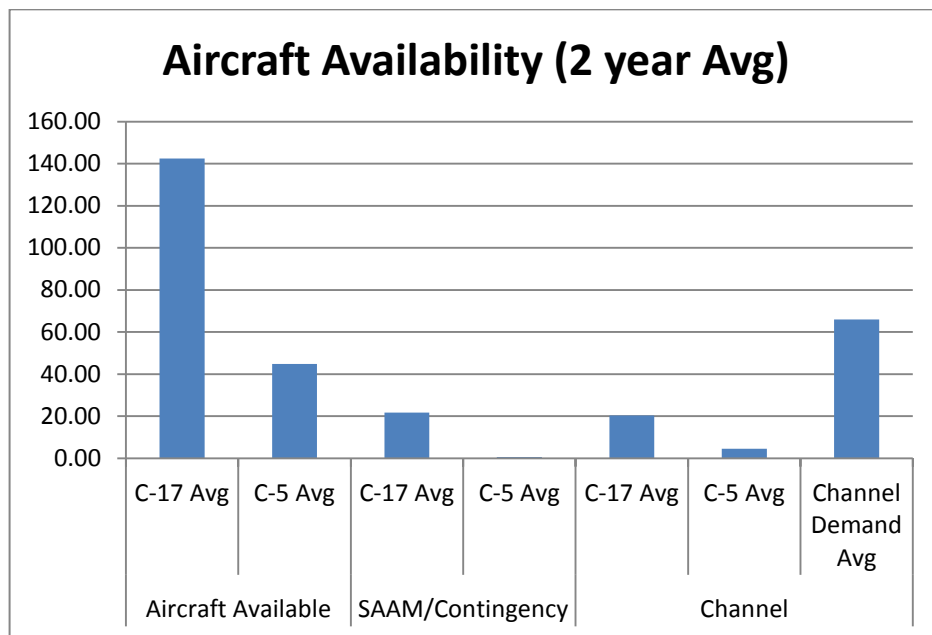


Figure 1: Aircraft Availability

### *Channel Aircraft Demand*

The maximum number of channel aircraft flown between calendar year 2011 and 2012 was 100 on the 117 Julian day in 2011 and the minimum was 24 on Julian day 363 in 2012. A scatterplot of the demand (Figure 2) shows a weak pattern with minimally reduced demand early in the calendar year and later in the calendar year. The demand for

2012 does appear to be less than 2011, but is not conclusive based on the short time frame compared. The demand for the channel aircraft could be met within two standard deviations for all but 6 days in 2011 and 12 days in 2012 utilizing 93.3 aircraft and 79.8 aircraft respectively (Table 4). Additionally, the split between which missions C-17s and C-5s are supporting is evenly distributed between channel and SAAM/Contingency although the data does indicate that C-5s tend to lean more towards channels on average.

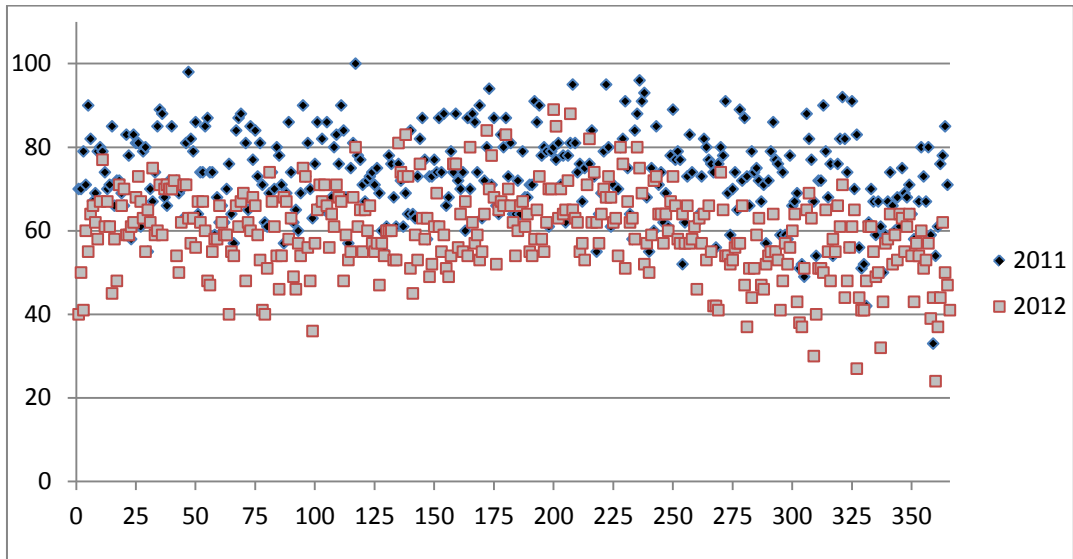


Figure 2: Channel Aircraft Demand

Table 4: Channel Demand

	<b>2011/2012 Channel Average (Combined)</b>	<b>2011 Channel Average</b>	<b>2012 Channel Average</b>
<b>Average</b>	66.06	72.82	59.39
<b>Standard Deviation</b>	8.38	10.26	10.21
<b>2 Standard Deviations</b>	16.75	20.52	20.43
<b>Max</b>	90	100	89
<b>Min</b>	38.5	33	24



### ***Validation***

Air Mobility Commands ability to surge when required by world events is evident. As was discussed earlier, March 2011 was an extremely busy month as a result of contingency operations in Afghanistan as well as natural disasters including an earthquake and tsunami in Japan, an air war in Libya and a Presidential trip to South America. All told, during the last week of March 2011, 127 C-17s and 33 C-5s were in the air at the same time around the planet (Eaglen, 2012). Cross checking those numbers with the data provided by AMC A/9 indicates that there was still additional capacity available as indicated in Table 5. This data still excludes Operation Enduring Freedom missions, but indicates that there would be additional capacity available beyond the channel missions flown. The data also suggests that despite the number of contingencies in March 2011, the organic aircraft fleet had the capacity to support both. The data indicates that there was no reduction in channels supported as a result of contingency operations, and in fact, the number of channels supported in March was higher than average for the rest of the year (see Table 6).

Table 5: March 2011 Snapshot

March 2011	Available	Channel	Contingency	Maximum Used
C-17 Average	140.34	24.00	26.65	78
C-5 Average	49.20	5.45	0.68	13

Table 6: 2011 Channel Support (C-5/C-17)

2011	C-17 Channel	C-5 Channel
Average	23.42	4.31
Standard Deviation	4.70	2.65
Maximum	37.00	15.00
Minimum	12.00	0.00

## **Objectives Answered**

**Objective 1:** How many C-17A Globemaster III and C-5A/B/C/M Galaxy aircraft are available on a daily basis?

Determining the number of C-17 and C-5 aircraft available on average relates directly to the capacity of the strategic airlift fleet. Based on the analysis of the 2011 and 2012 LIMS-EV data, 142.2 C-17s and 44.9 C-5s are available on a given day. The maximum number of C-17s available over the entire data set was 166.74 and the minimum number was 123.63. The maximum number of C-5s available over the entire data set was 63.67 and the minimum number was 32.75.

**Objective 2:** How many channel missions are flown on a daily basis?

The average daily demand over the course of 2011 and 2012 was 66.06. The maximum number of channel aircraft flown on one day was 100 and the minimum number was 24 over the entire data set.

**Objective 3:** How many channel missions does the organic strategic airlift fleet support and how much additional demand could they absorb?

On average, 20.32 C-17s are flying a channel mission per day and 4.52 C-5s are flying a channel mission per day. The maximum number of C-17s supporting channel operations on a specific day over the course of 2011 and 2012 was 37 and the minimum was four. The maximum number of C-5s supporting channel operations on a specific day over the same period was 15 and the minimum was zero. Figure 3 depicts the average aircraft available (C-17 and C-5) on a daily basis over the course of 2011 and 2012 as well as the average number of sorties flown supporting SAAM & contingency missions. The “Channel (All)” column depicts the number of channels flown by all participants

including USAF and civilian partners. Channel and contingency missions in support of Operation Enduring Freedom were excluded from the data set. As displayed in Figure 3, the average number of channels flown on a day for 2011 and 2012 was 66.06.

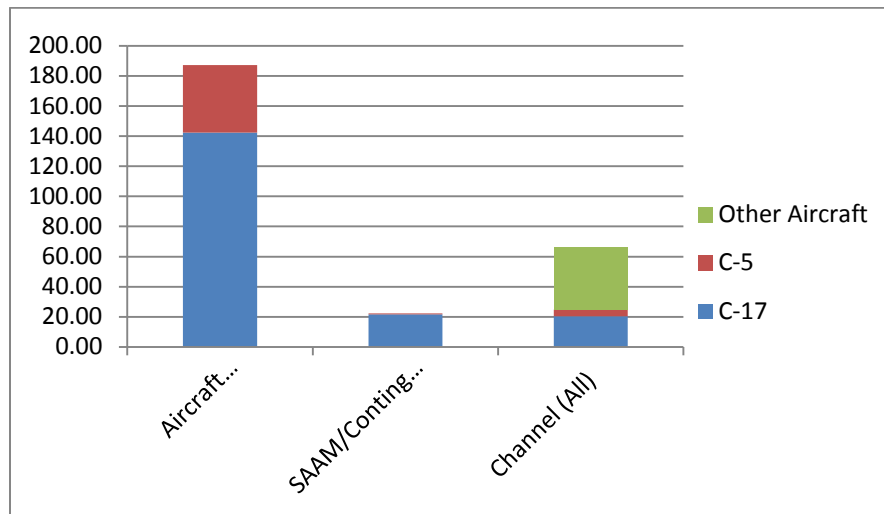
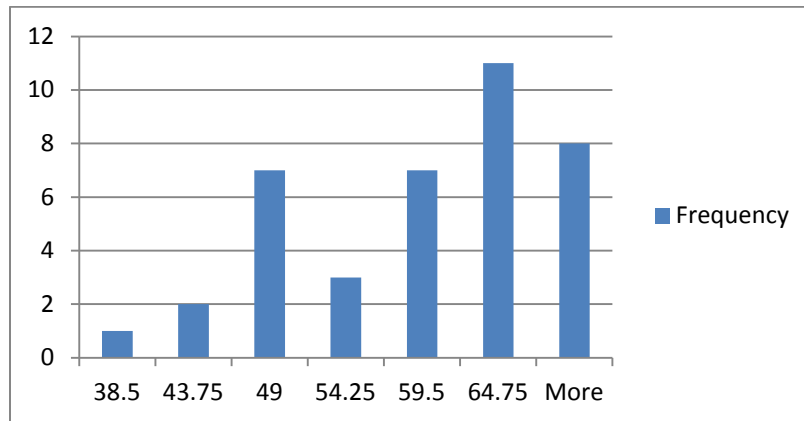


Figure 3: Aircraft Available versus Channel Demand

## Summary

The organic strategic airlift has the ability to support all channel missions currently managed by the Tanker Airlift Control Center based on the assumptions listed in Chapter 1 within two standard deviations. 82.81 aircraft would have been required on average to support all channels flown over the course of 2011 and 2012. Breaking the numbers down further, there would have been 12 days in 2011 and 6 in 2012 where more than two standard deviations of aircraft would be required out of 365 days. Essentially, 96.7% of 2011 would have been supported and 98.3% would have been supported in 2012 using only the organic fleet. Because the data has a negative skewed distribution (Table 7), using chebyshev's inequality would indicate that all missions would be supported with 75% confidence for two standard deviations.

Table 7: Average Channel Mission Distribution



## V. Conclusions and Recommendations

### Chapter Overview

This chapter examines the basic conclusions about the research, significance of the research and recommendations for future research.

### Conclusions of Research

The research presented above clearly indicates that during peacetime, the supply of organic strategic airlift is greater than the demand for channel airlift. The average number of C-17s and C-5s available on a given day as derived from the data received from the weapons systems is approximately 142 aircraft. The average number of channel missions flown over the same period was 66. The difference between aircraft available and channel missions flown on a daily basis indicates that the organic strategic airlift fleet consisting of C-17s and C-5s could meet all channel airlift requirements. Therefore, participation of contract airlift for day to day operations is not required in order to meet daily scheduled sorties. Contract airlift participation is only needed to the extent that they

are provided an incentive to provide aircraft for the CRAF program and as a result of unique capabilities that may not exist in the organic airlift fleet. Additionally, the disruption that occurs as a result of contingency operations does not appear to be caused by the number of strategic airlift aircraft available on a daily basis.

### **Significance of Research**

Historically, strategic airlift capacity has been analyzed utilizing a MTM/D approach as discussed in the MCRS-16 review. During high demand operations, efficient use of aircraft capacity is critical in order to meet the demand. During low density operations, excluding concerns for cost, efficient use of airlift is not as critical as aircraft availability. Ultimately, if the channel is scheduled to go on a frequency basis, an aircraft needs to be available in order to meet the requirement. This research analyzed actual tail availability and channel demand independent of cargo or passengers moved. Decision makers and mission planners can use this data to determine an appropriate mix between CRAF partners and organic airlift.

### **Recommendations for Future Research**

An in-depth cost analysis should be accomplished to determine how effective incentives have been on CRAF participants. Drastic fluctuations in aircraft committed to CRAF (Table 8) indicate the current incentives may not suffice. In addition, research should be accomplished to determine if any cost-benefit truly exists to fly cargo on CRAF carriers during extended periods of peace and to determine if the DOD should just pay CRAF carriers an incentive to participate from year to year but used organic airlift to

move a majority of the cargo and passengers. A review of aeromedical commitments and requirements should be reviewed to ensure sufficient capacity exists.

Table 8: Airlift Support pledged by CRAF Participants for Stage 3 (Merritt, 2013)

Civil Reserve Air Fleet (CRAF) Support		2011	2012	2013 <sup>b</sup>
Participating Carriers		35	31	28
Number and Type of Aircraft Pledged to CRAF	Passenger	686	823	392
	Cargo	175	163	162
	Aeromedical <sup>a</sup>	39	39	0

Source: GAO analysis of Air Mobility Command data.

Note: Aircraft noted above are included in the International Segment (Long Range & Short Range), Aeromedical Segment, and National Segment (including Domestic and Alaskan sections). In fiscal year 2011, TRANSCOM implemented changes to the CRAF program limiting the number of aircraft that would be accepted into the program.

<sup>a</sup>The Aeromedical requirement was reduced in fiscal year 2013 and currently no carriers are pledged to this segment.

<sup>b</sup>Aircraft enrolled in the CRAF program as of April 2013.

Moreover, a review of in-system selects and their impact on channel missions should be accomplished. As was previously mentioned, the disruption to the channel system is often times the result of short notice SAAMs that require assets to be used as soon as possible. In many cases, the Tanker Airlift Control Center will “pick-off” a crew and aircraft in the system to accomplish the higher priority mission and then backfill the mission that was abandoned. An analysis of the in-system select to determine the level of disruption that it causes could lead to mitigating techniques including the staging of crews and/or aircraft in a manner similar to FEDEX or Atlas Air Incorporated do with “reserve” or “backup” crews.

Finally, research would need to be accomplished to determine if channel flow and aircraft location impacts the availability of the strategic aircraft on a daily basis. This research did not address any impacts that may occur if a channel mission has a known delay that extends beyond 24 hours. A mission by mission review would need to be

accomplished to determine how many aircraft are on an active leg of a mission but did not fly on a specific day. That would cause an under-reporting of utilized tails and would lead to issues with the aircraft being “available” in the macro view, but in the wrong part of the world when a closer review is accomplished.

## **Summary**

This chapter provided the major conclusions drawn from the research. It also provided an explanation on the significance of the research and the gap that exists with capacity demand based on MTM/D versus aircraft availability. Overall, the organic strategic airlift fleet could support all Tanker Airlift Control Center managed channels on daily basis and support any major contingency of short duration. This research suggests that USTRANSCOM should review CRAF incentives to determine what level is required to maintain civilian participation while adjusting the mix between organic and civilian lift. Ultimately, the organic fleet has training requirements and a flying hour program that is often supplemented by contingency operations. As contingency operations in Afghanistan decrease, those training requirements will need to be accomplished via a different venue. “DOD Instruction 4500.57 requires that DOD operate its fleet to meet its training requirements and also requires that it use commercial sources of transportation to the ‘maximum extent practicable’” (Merritt, 2013). A cost-benefit analysis should be accomplished to determine the cost of flying organic aircraft empty versus the lower cost of moving cargo via civilian contracts.

## Appendix A

Table 9: Assignment Purpose Identifier Codes (Air Force Instruction 16-402, 2013)

1. Active Inventory. (AFI 21-103 Attachment 17)		
Code	Short Title	Data Code Definition
CA	Combat Support	Direct support of units engaged in conflict
CB	Combat Tactics OT&E	Developing, improving, or evaluating operational employment ability (OT&E)
CC	Combat	Delivering munitions or destructive material against or engaged in direct contact with enemy forces
CF	Combat Auxiliary Support	Aerospace vehicles assigned or possessed to accomplish essential functions that cannot be performed economically in the primary aerospace vehicles of combat and combat support units
EH	Test Support	Participation in test programs
EI	Test	Complete systems evaluation or testing to improve the capabilities of the weapon system
IF	Industrial Fund	Assigned by AMC for the accomplishment of weapon system program manager operations for airlift service
TF	Training	Student training, combat crew training or dissimilar air combat training or combat crew training
ZA	Special Activity	Special Missions (e.g., Aerial Demonstration, Embassy Liaison, Presidential Support)
ZB	Operation Support	Air Force directed support airlift during peacetime contingencies and wartime (e.g., priority personnel or cargo)



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